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## VII.

# LAW AND DESIGN IN NATURE.

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PROFESSOR NEWCOMB.

THE object aimed at in the present discussion is to take a first step toward securing a better understanding of each other's position between two conflicting schools of thought respecting the course of Nature. One of these schools we may call that of the scientific philosophy, because it is for the most part represented by investigators or students of science. The other is that of the religious philosophy, but in designating it thus we do not mean to imply that it is necessarily unscientific, any more than that the scientific school is necessarily irreligious. Perhaps it would be better to call it the theological school of thought, because it seeks in Nature to find proof of a directing Mind, while the other school studies Nature solely to learn her phenomena, and to draw such philosophic conclusions as may be founded on their study.

Whether there is a necessary conflict between the views of the two schools, we shall not pretend to say; we are concerned only with the fact that a conflict does exist, and that it turns on certain questions respecting what we may call the fundamental methods of Nature. It is assumed on both sides that there is some sort of uniform plan and method in the course of Nature, but there is not only no agreement, but no mutual understanding as to what that plan and method are. To the scientific school the other presents itself as criticising its fundamental position, and yet in no case directly denying it. So far as can be understood, the theological school refuses to express any opinion on the fundamental proposition on which the whole discussion turns, but appears equally ready to admit or deny it according to the bearing of the argument to be founded on such admission or denial. It is not pretended that this is a fair statement of the position they mean to occupy, but only that it is the manner in which their position presents itself to the other school. We need not discuss the question which side the fault is on, since

any party which does not understand the other has a right to state his difficulties, and to ask the other for explanation. The first step toward clearing the ground for a mutual understanding is, to state and explain the position taken by the scientific school, and to inquire of the other whether this position is entirely untenable. The fundamental postulate of the scientific philosophy is a principle founded on a limited series of observations, and extended by induction to the whole course of Nature. It may be expressed in the following words :

The whole course of Nature, considered as a succession of phenomena, is conditioned solely by antecedent causes, in the action of which no regard to consequences is either traceable by human investigation, or necessary to foresee the phenomena.

The sole question presented for discussion in the present series of papers is the following : To what extent is the above postulate consistent with sound doctrine ?

The somewhat vague term "sound doctrine" is used purposely in place of a more specific one, in order to give the representatives of the opposing school the widest range of position from which to express acquiescence or dissent. We might have inquired whether the doctrine is consistent with the action of a Supreme Will in the processes of Nature ; whether it can be reconciled with the doctrine of final causes, or with any other doctrine respecting the relation of the Creator to his works which one might think proper to propound. But, by doing so, we should narrow the field of inquiry in such a way as to make the result indecisive, and therefore unsatisfactory.

It must also be noted that we do not inquire whether the hypothesis is itself sound in doctrine, but only whether it is consistent with soundness. It would be vain to expect in a single discussion to reach any result respecting its absolute truth or falsity, or even to argue its truth in its widest extent. The question of its truth enters in this indirect way : that, if it is inconsistent with any admitted or observed fact, it will be allowable to demonstrate the inconsistency. So also if it may be accepted within certain definable limits, but is not admissible beyond those limits, that fact ought to be clearly understood. And we may remark, at the outset, that if one admits that the postulate may, for aught we know, be true for the whole field of phenomena, he admits all that the scientific school claims in this connection. The postulate is, in fact, presented as a scientific and not as a theological principle, and the question whether it is valid as such must be settled before any conclusion in a field higher than that of phenomena can be founded upon it.

In order to confine the discussion as closely as possible to the exact points of real or possible differences, we shall briefly explain the postulate in such a manner that there shall be as little room as possible for misunderstanding it. In doing so we shall make no attempt to argue its truth or falsity, but only seek to make known its meaning and scope. The difficulties which have heretofore arisen have their origin partly in a misconception as to what the scientific philosopher means when he speaks of reducing phenomena to general laws, or explaining them by the operation of natural causes, and partly from a failure to distinguish clearly between phenomena as such and the abstract ideas with which they may be associated. It is worthy of remark that the difficulty of understanding the postulate arises not from its complexity or the abstract character of the ideas involved in it, but from its extremely simple and concrete character. It involves no ideas but such as are familiar from childhood and really understood by children, though they may not be able to express them in language. We are indeed in a difficulty similar to that which might be encountered by a rustic when called upon to define what he meant by a loaf of bread before a Professor of Logic, and to word his definition in such a way as to stand good against all the Professor's analysis. If our own attempt fails to stand analysis, we shall repose on the same hope that would sustain the rustic—namely, that, after all, his interlocutor understood what a loaf of bread was just as well as as he did himself.

The first point to be explained is, what is meant by considering the course of Nature simply as a succession of phenomena. The reason for this restriction is, that we must agree about phenomena before we can have any intelligent discussion respecting what lies behind or above them. The meaning of the restriction is, that we eliminate from our discussion all those abstract conceptions which are frequently associated with phenomena, but which do not serve to assist in defining phenomena. Among these conceptions are the opposing ones of potentiality and necessity, which several schools of philosophers persist in trying to impose on phenomena. These conceptions have no place whatever in scientific investigation, and are therefore not to be in any way brought into the present discussion. For instance, the scientific philosophy does not assert that gravitation "must" act, that a stone "necessarily" falls, or that the course of Nature "can not" do otherwise than conform to mathematical laws; it only asserts that as a simple matter of fact gravitation does act, and events in Nature do occur in conformity with defina-

ble laws. If we admit this, the question is settled without discussing the question of necessity. Nor is it any argument against the postulate to maintain or show that things may, might, could, or would be, different from what they are, because the postulate considers things only as they are and not as they may be. The only modifications of a proposition which it admits are: The fact is so; the fact is not so; I do not know whether the fact is or is not so. The latter, it will be remarked, does not express anything respecting the fact, but only a state of ignorance confined to our own minds.

Another class of conceptions associated with phenomena, but entirely excluded in the present discussion, are those of the invisible forces or causes which may lie behind the visible course of Nature. Respecting this every one is at liberty to hold any opinions without coming into conflict with the scientific philosophy, provided only that he draws no conclusion inconsistent with what the other believes to be a legitimate induction from observation. For instance, it is not objectionable to the postulate to say that all things are determined by a Divine Will, because the postulate assumes nothing respecting such will, and has nothing whatever to do with its supposed immanence in the whole course of Nature, unless conclusions inconsistent with observed facts are founded upon it. So long as the religious school admits that stones fall, water runs, and storms move, according to the scientific postulate, they may place any occult causes behind those phenomena which do not lead to results incompatible with it. For the same reason there is no objection to maintaining that things were designed to be as they are, unless such design is considered to be a physical cause which can be traced by studying such things.

We now reach the main proposition, that the course of Nature is conditioned solely by antecedent causes, in the action of which no regard to consequences can be traced. We use the word "conditioned" instead of "determined," to do away with all conception of necessity, and to avoid being understood as saying that things must be instead of simply saying that things are. We also use the very ambiguous word "cause," susceptible of being pulled to pieces, and shown to mean everything, anything, or nothing, at pleasure, in its ordinary every-day sense, which everybody understands, and which therefore need not be further defined. If it be replied that this every-day sense is vague, and susceptible of minute subdivisions into different meanings, we reply that any meaning consistent with ordinary ideas may be assigned to it.

The further distinction of what is meant can be better understood by example than in any other way. Let us take the case of the destruction of a theatre by fire, and inquire why it occurred. We can give three answers :

1. That the fire was the work of a Higher Being, who desired to attain some end. Perhaps there were bad people in the theatre, who were to be punished or prevented from further crime ; or perhaps the theatre was injuring the morals of the community, and was therefore burned for the public good.
2. That the cause was entirely inscrutable, and therefore such as to elude all human investigation.
3. That it occurred in one of the many ways by which every one knows that fires may occur, and that the character of the theatre or the intentions of the wicked people had nothing at all to do with the matter.

Of these three possible modes of occurrence of the fire, only the third is admitted by the postulate of the scientific school as affording an explanation. By an explanation we mean the statement of a general principle covering all cases of the origin of fires, and of some special facts showing the fire to be the combined result of the fact and the principle. For instance, whenever a match is rubbed in a certain way and in a certain position relative to a piece of drapery, a fire will be the result. In this case the required conditions were fulfilled by an actress treading upon a match. The fire will always result when these same conditions are fulfilled, no matter what the character of the play or of the audience. But, according to the scientific postulate, we could make no such general assertion respecting the first explanation, which is therefore inadmissible as an explanation.

As another example we may take the motions of the planets. By assuming that these motions take place in accordance with the law of universal gravitation, the astronomer is enabled to predict, years or centuries in advance, that the moon's shadow will pass over certain regions of the earth at certain stated times. Why can he not predict every natural occurrence—the earthquakes, the storms, the floods, the plagues of the future—with equal certainty? The answer of the postulate is, that it is only on account of his want of knowledge and want of reasoning power. A mind capable of expressing in language the necessary data, fully acquainted with certain laws, and possessed of a calculus of sufficient power, could foresee the end of all things from the beginning by a process the same

in kind as that by which the mathematician foresees the celestial motions. The celestial motions, phenomenally conditioned by the law of gravitation and by the initial circumstances of the motions, are supposed to symbolize the whole course of inanimate Nature, so far at least as the phenomena are concerned.

We have presented an antithesis between the theory presented for discussion and the theory of final causes which assumes that things have been arranged with a visible purpose. But the ground is frequently taken that there is really no antagonism between these two theories, and that the doctrine of a course of Nature proceeding in accordance with invariable laws is entirely consistent with the doctrine of final causes. But, notwithstanding this occasional assertion of consistency, every advance of the scientific philosophy toward presenting a complete theory of the course of Nature in accordance with their doctrine is vigorously contested. Now, if theologians find the doctrine alluded to not inconsistent with their views, they have no right to contest it in the manner that they do ; and the scientific philosopher has a right to presume that their seeming inconsistency is founded on some failure between the two schools to give the same meaning to the term, laws of Nature. An understanding on this point can be best reached, not by an abstract definition, but by concrete examples of the meaning of the scientific postulate, like those just given. Just so far as the theologian can reconcile the motions of the planets or the burning of the theatre with final causes or with a directing hand, so far is he at liberty to reconcile the whole course of Nature in the same way.

We have stated the scientific postulate in the widest and most general terms. Had we been disposed to narrow the inquiry, we might have substituted for it a statement of the doctrine of evolution, because it is here that the dispute is at present raging with most bitterness. But, since the doctrine of evolution is itself founded on the postulate, our discussion is more complete if we include the more general proposition. The theory of evolution maintains that certain forms formerly supposed to be the result of special creation are really the product of natural causes of precisely the same character with those which cause the movement of storms and the chemical changes going on in the world around us. Hence a consideration of the theological tendencies of the one will include the same thing for the other.

SIMON NEWCOMB.

## DR. PORTER.

PROFESSOR NEWCOMB, it will be observed, opens the discussion by giving his views of the antagonistic positions taken by the scientific and theological schools respectively in regard to the course of Nature. So far as the last school is concerned, I am compelled to say that he evinces more candor and desire to be just than success in stating what he conceives this school to hold. What he criticises it for holding, and implies that it does hold, is something like this: The theological school conceives final causes to be coördinate with efficient or physical causes, holding that they are manifested by similar indications and are tested by similar experiments. In the example cited of the burning of a theatre, the scientific school recognizes only physical agencies or causes; the theological discerns a final cause, or the purpose of "a Higher Being who desired to attain some end," i. e., a moral effect, and directly produces it, as the torch causes the physical conflagration.

I can not accept this as a correct statement of what is taught or implied by any school of thinkers which holds that design or final cause is manifest in the course of Nature, or must be assumed to explain it. The arguments which Professor Newcomb arrays against this view seem to me as uncalled for as the fiction toward which he directs them is imaginary.

Leaving this point to return to it again, I pass to his view of "the fundamental postulate of the scientific philosophy," as it is stated by himself. "The whole course of Nature, considered as a succession of phenomena, is conditioned solely by antecedent causes, in the action of which no regard to consequences is either traceable by human investigation or necessary to foresee the phenomena." This statement, it will be seen, is divided into two portions, an affirmation and a denial. The affirmation seems to me defective for its omissions, the denial to be false, and the postulate itself to be therefore inconsistent with sound doctrine. By sound doctrine I mean truth of any kind, whether it pertains to the science of Nature, the science of man, or the science of God. I do not argue from the inferences or consequences to theology that might follow from the postulate that it is therefore untrue, but that it is unsound in what it omits and denies, and for this reason is inconsistent with "sound doctrine." I have no favors to ask and no appeals to make as a theologian, but write only in the interests of science and the truth.

The defects of the affirmative part of the postulate are made more obvious by the author's subsequent explanations of his mean-

ing. He tells us that, in asserting that science concerns itself with the succession of phenomena, he desires to get rid of those abstract conceptions which are often associated with phenomena—particularly “potentially and necessity.” We are tempted to inquire whether these conceptions are any more abstract than the conception of “succession”? We also inquire whether the assertion in the postulate, that this succession of phenomena is “conditioned solely by *antecedent causes*,” does not imply the presence and validity of these very conceptions of potentiality and necessity? If the author denies causation with potentiality and necessity, he must limit science to inquiries respecting “succession,” and assign to it a narrower sphere than the positivists who recognize the relation of similarity and succession.

He proceeds to assert that the only question with which science concerns itself is what can be established as *a fact*. We wait to be informed what he means by a fact or phenomenon. Does he mean that science concerns itself with facts or phenomena as such, or with facts and phenomena as *related*? If the latter, is not the question open whether the relations of *design* may not as properly be called facts as the relations of *time* or *causation*?

He adds, all “invisible forces or causes” which “lie behind the visible course of Nature” must be excluded, and again, all “occult causes.” But why are relations of design, or the facts or phenomena which they explain, any more invisible or occult than the relations of succession or causation? Perhaps by “invisible” and “occult” he means spiritual as contrasted with physical, and thus would limit Nature to material forces and phenomena, excluding spirit from holding any place in Nature or any relations to Nature, or any agency in its phenomena, which science is bound to recognize.

Whatever view we take of the affirmation of this postulate, it unwarrantably narrows the conception of the course of Nature as the subject-matter of science. We would widen that conception as follows:

1. The course of Nature includes the phenomena and facts of spirit as truly as those of matter. Scientifically considered, the one are no more “invisible,” “occult,” or “abstract” than the other. Of the two, the agency of spirit is more visible, manifest, and concrete than any agency of matter in the production of that effect which we call science.

2. These facts or phenomena, these forces or agents, are connected by various relations, as of time and space, involving number and geometry; also of likeness or analogy, cause and effect, and per-

haps others. These are the materials from and by which science is constructed by the rational spirit, as it determines the properties, forces, and preëminently *the laws* of both matter and spirit. That Professor Newcomb should fail to emphasize the preëminence of laws as the subject-matter of science may well occasion surprise.

3. Laws are affirmed of the action of forces as "conditioned" or modified mathematically in the production of effects by relations of time or space; also as conditioned by one another when two or more forces act together in the production of any constant or regular effect. In the discovery of forces, properties, or laws, science is not, however, shut up to the use of mathematical tests or verifying experiments. Some sciences of matter, even, e. g., physiology, do not admit these criteria. Even those which do, recognize very largely the facts and analogies, the interpretations and probabilities, which precede and follow such tests. Every one of them makes the most liberal use of facts and relations, which must be assumed as the preconditions of the experimental element in induction.

4. A universe of law is, *ipso facto*, a universe of design. A "course of Nature" the phenomena of which occur in regular succession, much more a course of Nature conditioned by causes, is neither thinkable nor explicable except by antecedent and controlling purpose. Professor Newcomb says it is assumed that there "is some sort of *uniform plan and method* in the course of Nature." But plan and method imply design, or at the least are best explained by design. Design is objective thought—"a plan or method," "the *fundamental method of Nature*," as Professor Newcomb elsewhere says. Objective thought is completed and explained by a subjective thinker whose plans and methods science interprets.

5. Induction itself requires design, or "a plan or method in the course of Nature" as its postulate. Professor Newcomb says that the fundamental postulate of the scientific philosophy is "founded on a limited series of observations, and extending by induction to the whole course of Nature." But he forgets that he has already provided a postulate still more *fundamental*—if this is not an Hibernicism—in asserting "a plan and method" in Nature. Moreover, what he calls "extending by induction" can be explained and justified only by a belief in interpretable analogies, which are explicable only by design, or "fundamental methods of Nature."

6. The course of Nature furnishes constant examples of the interaction of matter and spirit. Subjective thought makes itself manifest as objective thought through material phenomena. Though

the same media, objective thought and subjective thought are interpreted by the rapid processes of natural induction. Moreover, thought or spirit controls matter and produces and prevents, modifies and arrests, the operation of physical agencies without hindering their activity or interfering with their laws. It is true the mutual relations of spiritual and material force are very imperfectly understood, and the laws of their coaction are inexactly determined, but the fact that they act in harmony with one another—while both are potent factors to varying effects—can not be questioned. All this is affirmed in the postulate of *a plan or method* in Nature, and confirmed by our experiments and observations.

7. In the economy of Nature, spirit is of greater significance than matter, and the phenomena and effects of the physical universe proceed in subservience to ends which concern rational and sentient beings. This is assumed by Science itself, and by Art, the servitor of Science. What were the unknown and the unused powers of Nature, were they reflected by no interpreting mind and transfigured by no imitative or constructive skill? What were these intellectual achievements of science and art, if they did not minister to the enjoyments of sentient souls? What were sentient enjoyment, were it not used as a motive for gratitude and love and worship in those who, in knowledge, enjoyment, and duty are like God, the Being who is the fundamental postulate of all science, and the moral Ruler of the spirits who interpret his thoughts, his feelings, and his will?

Thus far we have sought to supply what is omitted in what Professor Newcomb affirms of the course of Nature. Our enlarged definition will enable us briefly to dispose of *his denial*, viz., "in the action of which no regard to consequences is either traceable by human investigation or necessary to foresee the phenomena." By "a regard to consequences," he must mean consequences as designed, not merely physical sequences, but psychical or spiritual effects, more exactly sentient or moral good or evil. When he says that these "can not be traceable by human investigation," he may mean that they can not be tested by a certain class of scientific criteria or processes, i. e., by mathematical formulæ or physical experiments. Taken in this sense his words are true; but if he means that their presence and agency can not be discerned and proved by evidence as satisfactory as that which is technically called scientific, and indeed by evidence precisely similar to that which is accepted for many facts and truths in physical science, we dissent from him altogether. No man who rightly estimates the variety in the kinds of evidence

which enforces our belief in the various facts and truths of physical science would deny that design or purpose is as clearly traceable in many of the arrangements and phenomena of Nature as the causes or laws that are ascertained by experiment or induction.

In the example of the destruction of a theatre by fire, Professor Newcomb gives three possible answers to the question "why it occurred." Overlooking that "why" in such a connection may mean "whence," "how," or "for what," as it asks for answers in the terms of *a cause, a law, or an end*, he insists that only one of two answers can be given, viz., either "the fire was the work of an action of a Higher Being," or was the effect of any of the ordinary physical agencies, and reasons as though the one necessarily excluded the other. In other words, he overlooks the solution that the effect might be caused by physical agencies, and still be designed by God.

He subsequently refers to this last position as possible, but he obviously regards it as a theory for which theologians are responsible and are bound to look after, but which has no scientific value. Had he but reflected that *events* in Nature and spirit, whether designed or undesigned, are to be distinguished from the *forces* and even from the *laws of Nature*, and that similar forces, acting under fixed laws, are capable of an indefinite variety of effects, and that an indefinite variety of physical effects may be adjusted to an equally indefinite variety of psychical needs by a designing mind, he would have seen that science provides the amplest room for the accomplishment of the utmost conceivable variety of the designs of a Higher Being, and all by means of the forces and laws of Nature.

The example from the motions of the planets he presses to another application. In astronomy, he says, we not only can explain the present but can predict the future, and, had we the same insight into the agents and laws of other phenomena, we could in like manner predict the minutest event in any department of the physical universe. From this he would have us conclude that the possibility of inferring "a visible purpose" is excluded if design is admitted. To this we reply that the constancy of the operations of Nature and the consequent possibility of foreseeing the minutest consequences are no more inconsistent with the belief in design in the future than an insight into these forces and operations of Nature is inconsistent with such belief at any present moment. But why, then, do theologians so vigorously contest "every advance of the scientific philosophy toward a complete theory of the course of Nature in accord-

ance with their doctrines?" We reply that, had Professor Newcomb, in this and other discussions of this topic, insisted that the course of Nature as truly manifests design as it does the causes or the successions of phenomena, one theologian at least would not have vigorously contested his opinions of design, however unsatisfactory he might have found some of his conceptions of the sphere and postulates of science.

We ought not to be surprised that Professor Newcomb, being an astronomer, should so confidently assert that the celestial motions are supposed "to symbolize the whole course of inanimate Nature." But Nature is also animate and ensouled, and the forces and laws which control the activities of life and spirit may not be symbolized by the celestial motions. The eminent Du Bois-Reymond, in his well-known address on the limits of our knowledge of Nature, after discoursing of what he calls the astronomical knowledge and foreknowledge of Nature's forces and laws and events, draws a sharp line between the field of this *astronomical knowledge* and the agencies and relations in the course of Nature which can never be thus mastered. In respect to some of these questions he is content to say, *ignoramus*—in respect to others, *ignorabimus*. If this is true of the forces and relations of Nature, how much more must it be true of the relations which the self-existent Creator holds to the phenomena and laws of both matter and spirit as they manifest his thoughts and accomplish his designs!

NOAH PORTER.

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MR. COOK.

KEPLER relates that one day, when he had long meditated on atoms and their combinations, he was called to dinner by his wife, who laid a salad on the table. "Dost thou think," said he to her, "that if from the creation plates of tin, leaves of lettuce, grains of salt, drops of oil and vinegar, and fragments of hard-boiled eggs were floating in space in all directions and without order, chance could assemble them to-day to form a salad?" "Certainly not so good a one," replied his fair spouse, "nor so well seasoned as this." (Claude Bertrand, "Les Fondateurs de l'Astronomie moderne," p. 154.)

In Baron d'Holbach's parlor, in a company of atheists, the witty Abbé Galiani said: "I will suppose, gentlemen, that he among you who is the most fully convinced that the world is the effect of chance is playing with three dice—I do not say in a gambling-house, but in

the best house in Paris. His antagonist throws sixes once, twice, thrice, four times—in a word, constantly. However short the duration of the game, my friend Diderot, thus losing his money, will unhesitatingly say, without a moment's doubt: ‘The dice are loaded; I am in a bad house.’ What, then, philosopher? Because ten or a dozen throws of the dice have emerged from the box so as to make you lose six francs, you believe firmly that this is in consequence of an adroit manœuvre, an artful combination, a well-planned roguery; but, seeing in this universe so prodigious a number of combinations, thousands of times more difficult and complicated, more sustained and useful, you do not suspect that the dice of Nature are also loaded, and that there is above them a great rogue who takes pleasure in catching you.”

In a corner of his garden, a Scotch philosopher, the wise Beattie, drew with his finger the three initial letters of his child's name, sowed the furrows with cresses, and smoothed the earth. The child was only six or seven years of age, and was learning to read, but had been taught nothing concerning God. “Ten days after,” says Beattie, “the child came running to me all amazed, and told me his name had grown in the garden. I smiled at these words, and appeared not to attach much importance to what he had said. But he insisted on taking me to see what had happened. ‘Yes,’ said I, on coming to the place, ‘I see well enough that it is so, but there is nothing wonderful in this—it is a mere accident,’ and went away. But he followed me, and, walking at my side, said very seriously: ‘That can not be. Some one must have planted the seeds to make the letters.’ ‘You think, then, this is not the result of chance?’ ‘Yes,’ said the boy firmly, ‘I think so.’ ‘Well, then, look at yourself; consider your hands and fingers, your legs and feet, and all your members. Do they not seem to you regular in their appearance and useful in their service? Can they be the result of chance?’ ‘No,’ was the answer, ‘some one must have made them.’ ‘Who is that some one?’ I asked him, and he replied that he did not know. I then made known to him the name of the great Being who made all the world; and the lesson was never forgotten, nor the circumstance which led to it.”

These familiar concrete examples emphasize the distinction made prominent by Chalmers, and after him by Mill, between the laws of matter and the collocations of matter. “We can imagine all the present and existing laws of matter to be in full operation,” said Chalmers (“Natural Theology,” ii., 11), “and yet, just for want of a

right local disposition of parts, the universe might be that wild, undigested medley of things in which no one trace or character of a designing architect was at all discernible." Mr. Mill says ("Logic," iii., 12, 16) that "collocations as well as laws are necessary to the operation of Nature," and he does not overlook the profound truth that "the laws of Nature do not account for their own origin." Professor Newcomb glances at this distinction, but apparently does not see that in doing so he makes a concession which flatly contradicts his theory. "The celestial motions," he tells us, are "phenomenally conditioned by the law of gravitation *and* by the initial circumstances of the motions." The question is, What accounts for those "initial circumstances"? Is any "regard for consequences" traceable in them? The word "and" in the above sentence of Professor Newcomb's is in fatal conflict with the word "solely" in his postulate.

A slovenly observation of facts and a lack of rigor in applying to the explanation of facts the principle that every change must have an adequate cause are the most ordinary sources of skepticism as to the existence of design in Nature. A specialist may be lynx-eyed and yet wall-eyed.

Is there in the universe intention not my own? Every one answers, "Yes—in other human beings." But, precisely the same argument which proves to me that a human being other than myself has had an intention in any given work proves that a Supreme Intelligence has had an intention in what is called Nature. It is inconsistent with sound doctrine for me to deny that other human beings have intentions. It is for the same reason inconsistent with sound doctrine for me to deny that the Supreme Intelligence has intentions, or that Nature has final as well as efficient causes?

1. Let cause mean all that is necessary to explain an effect.
2. In a statue of Hercules we shall have, therefore, according to Aristotle's distinctions between causes, first, a material cause in the marble; an efficient cause in the chisel of the sculptor; a formal cause in the shape of the statue; and a final cause in its destination to be set up to adorn a temple.
3. All these causes may coexist. Neither in man's work nor in Nature does the operation of efficient causes shut out that of final causes.
4. The fullest proof that the course of Nature is governed by efficient causes would be no disproof that it is also governed by final causes. To prove that a statue is made by a chisel is no disproof that it was made in order to represent Hercules, and to be set up in a temple.
5. It is the absurd claim of many physicists, who have not

studied philosophy, that efficient and final causes exclude each other, but the better educated of physicists make no such claim.

Huxley says : "The teleological and mechanical views of Nature are not necessarily mutually exclusive. The teleologist can always defy the evolutionist to disprove that the primordial molecular arrangement was not *intended* to evolve the phenomena of the universe."

6. Without here raising the question whether the theory of evolution is true or false, it is evident that it concerns only a question of process, or answers the question *How?* and not the question *Why?*

7. But the question *How?* does not exclude the question *Why?* and so the theory of evolution does not render final causes either impossible or useless.

8. Combinations of repeated and multiplex phenomena, such that they converge to one effect, exist in countless numbers in Nature.

9. Convergence of phenomena in repeated and multiplex cases is itself a phenomenon, and requires a cause.

10. When a certain coincidence of phenomena is remarked constantly, it is not enough to explain each phenomenon by referring it to its antecedent ; it is necessary to give a precise reason for the coincidence itself. (See Janet, "Final Causes," book i., chapter i., and book ii., chapter i.)

11. Certain combinations, as for example of the parts of the eye, are intelligible only on the supposition that millions of forces have combined so as to produce sight.

12. There is here a strange accord of the past with the future.

13. It is a fact of observation that this accord of the past with the future exists in Nature in cases innumerable.

14. It is to be false to the principle of causality to leave unexplained this accord of the past with the future.

15. As a cause must include all that is necessary to explain an effect, the plurality of causes is itself a proof that involution and evolution under natural law are an eternal equation.

16. But the strange accord of the past with the future in the growth of the eye will be fortuitous, or without adequate cause, if it is not granted that the combination of parts has taken place under control of a tendency that from the first has in view the sight, which springs up only at the last. The combination of millions of forces *so as* to produce sight is intelligible only on the principle that they have been combined *in order* to produce sight. "When the question is about an organic evolution which is in the future," says Claude Bernard, "we no longer comprehend the property of matter

at long range. The egg is to become something ; but how conceive that matter should have as a property to include operations of mechanism which do not yet exist ?" John Stuart Mill, in a well-known passage of his essay on "Theism," admits that the argument just stated concerning the eye is in strict accordance with the principles of inductive logic.

17. This reasoning does not start from the hypothesis that sight is an end, nor that the eye is an adaptation of means to an end, for either of these presuppositions would involve a vicious circle.

18. The reasoning starts from effects merely as effects, and from the observation that they are possible only because a certain strange accord exists between the past and the future, and this in the action of millions of forces.

19. The observation of facts, therefore, gives us as a criterion of final cause the agreement of the present and past with the future, and the determination of the former by foresight of the latter.

20. The demonstrated accord of the past and the future in the growth of the eye and the innumerable similar examples transforms the effects into ends, the causes into means, and the combination of the two into an adjustment of means to ends or *design*.

Professor Bain, the most self-consistent of the British materialistic school, admits that inertia is as clearly a property of matter as extension ("Mind and Body," last chapter). By inertia is meant the incapacity to originate force or motion. Nevertheless, this philosopher would give to matter a spiritual as well as a physical side, and yet he admits that the only possible union of spiritual and physical qualities in "one substance" is that of "close succession" in time. This latest and subtlest attempt to avoid the self-contradictions of materialism is equivalent to the assertion that, although a door can not be open and shut at one and the same time, yet, if you will open and shut it fast enough, it may be ! The attempt has of course failed, and so the usual argument from the inertia of matter retains all its force :

1. If matter is essentially inert, that is, incapable of originating force or motion, all force and motion in matter originate in mind.

2. But matter is essentially inert.

3. Therefore, all force and motion in matter originate in mind.

The chasm between the primordial star-dust and the solar system, as well as that between the lifeless and the living forms of matter, can therefore be bridged only by the teleological as distinct from the mechanical theory of force.

MR. CLARKE.

In the paper which opens this discussion on "Law and Design in Nature," Professor Newcomb announces in a single sentence a proposition, the truth or falsehood of which, he tells us, is "the sole question presented for discussion in the present series of papers."

But, as soon as we examine this proposition, we find that it contains not one sole question, but three. The three are independent of each other, and do not necessarily stand or fall together. They are these :

1. "The whole course of Nature, considered as a succession of phenomena, is conditioned solely by antecedent causes."

2. In the action of these causes, "no regard to consequences is traceable."

3. And no regard to consequences is "necessary to foresee the phenomena."

Of these three propositions I admit the truth of the first ; deny the truth of the second ; and, for want of space, and because of its relative unimportance, leave the third unexamined.

The first proposition is so evidently true, and so universally admitted, that it was hardly worth positing for discussion. It is merely affirming that every natural phenomenon implies a cause. The word "antecedent" is ambiguous, but, if it intends logical and not chronological antecedence, it is unobjectionable. So understood, we are merely asked if we can accept the law of universal causation ; which I suppose we shall all readily do, since this law is the basis of theology no less than of science. Without it, we could not prove the existence of the first cause. Professor Newcomb has divided us into two conflicting schools, one of theology and the other of science. Taking my place in the school of theology, I think I may safely assert for my brethren that on this point there is no conflict, but that we all admit the truth of the law of universal causation. It will be noticed that Professor Newcomb has carefully worded his statement, so as not to confine us to physical causes, nor even to exclude supernatural causes from without, working into the nexus of natural laws. He does not say "antecedent physical causes," nor does he say "causes which have existed from the beginning."

Admitting thus the truth of the first proposition, I must resolutely deny that of the second ; since, by accepting it, I should surrender the very cause I wish to defend, namely, that we can

perceive design in Nature. Final causes are those which "regard consequences." The principle of finality is defined by M. Janet (in his recent exhaustive work, "Les Causes finales") as "the present determined by the future." One example of the way in which we can trace in Nature "a regard to consequences" is so excellently stated by this eminent philosopher that we will introduce it here: "Consider what is implied in the egg of a bird. In the mystery and night of incubation there comes, by the combination of an incredible number of causes, a living machine within the egg. It is absolutely separated from the external world, but every part is related to some future use. The outward physical world which the creature is to inhabit is wholly divided by impenetrable veils from this internal laboratory; but a pre-established harmony exists between them. Without, there is light; within, an optical machine adapted to it. Without, there is sound; within, an acoustic apparatus. Without, are vegetables and animals; within, organs for their reception and assimilation. Without, is air; within, lungs with which to breathe it. Without, is oxygen; within, blood to be oxygenized. Without, is earth; within, feet are being made to walk on it. Without, is the atmosphere; within, are wings with which to fly through it. Now imagine a blind and idiotic workman, alone in a cellar, who simply by moving his limbs to and fro should be found to have forged a key capable of opening the most complex lock. If we exclude design, this is what Nature is supposed to be doing."

That design exists in Nature, and that earthly phenomena actually depend on final causes as well as on efficient causes, appears from the industry of man. Man is certainly a part of Nature, and those who accept evolution must regard him as the highest development resulting from natural processes. Now, all over the earth, from morning till evening, men are acting for ends. "Regard to consequences is traceable" in all their conduct. They are moved by hope and expectation. They devise plans, and act for a purpose. From the savage hammering his flint arrow-heads, up to a Shakespeare composing "Hamlet," a Columbus seeking a new way to Asia, or a Paul converting Europe to a Syrian religion, human industry is a constant proof that a large part of the course of Nature on this earth is the result of design. And, as man develops into higher stages, this principle of design rises also from the simple to the complex, taking ever larger forms. A ship, for instance, shows throughout the adaptation of means to ends, by which complex adaptations produce a unity of result.

And that there is no conflict between the action of physical causes and final causes is demonstrated by the works of man, since they all result from the harmonious action of both. In studying human works we ask two questions—"How?" and "Why?" We ask, "What is it for?" and "How is it done?" The two lines of inquiry run parallel, and without conflict. So, in studying the works of Nature, to seek for design does not obstruct the investigation of causes, and may often aid it. Thus Harvey is said to have been led to the discovery of the circulation of the blood by seeking for the use of the valves of the veins and heart.

The human mind is so constituted that, whenever it sees an event, it is obliged to infer a cause. So, whenever it sees adaptation, it infers design. It is not necessary to know the end proposed, or who were the agents. Adaptation itself, implying the use of means, leads us irresistibly to infer intention. We do not know who built Stonehenge, or some of the pyramids, or what they were built for; but no one doubts that they were the result of design. This inference is strengthened if we see combination toward an end, and preparation made beforehand for a result which comes afterward. From preparation, combination, and adaptation, we are led to believe in the presence of human design even where we did not before know of the presence of human beings. A few rudely shaped stones, found in a stratum belonging to the Quaternary period, in which man had before not been believed to exist, changed that opinion. Those chipped flints showed adaptation; from adaptation design was inferred; and design implied the presence of man.

Now, we find in Nature, especially in the organization and instincts of animals, myriads of similar instances of preparation, combination, and adaptation. Two explanations only of this occurred to antiquity—design and chance. Socrates, Plato, and others, were led by such facts to infer the creation of the world by an intelligent author—"ille opifex rerum." Democritus, Epicurus, and Lucretius, ascribed it to the fortuitous concourse of atoms. But modern science has expelled chance from the universe, and substituted law. Laplace, observing forty-three instances in the solar system of planets and their satellites revolving on their axes or moving in their orbits, from west to east, declared that this could not be a mere coincidence. Chance, therefore, being set aside, the question takes another form: "Did the cosmos that we see come by design or by law?"

But does this really change the question? Granting, for exam-

ple, the truth of the theory of the development of all forms of life, under the operation of law, from a primal cell, we must then ask, "Did these *laws* come by chance or by design?" It is not possible to evade that issue. If the universe resulted from non-intelligent forces, those forces themselves must have existed as the result of chance or of intelligence. If you put out the eyes, you leave blindness; if you strike intelligence out of the creative mystery, you leave blind forces, the result of accident. Whatever is not from intelligence is from accident. To substitute law for chance is merely removing the difficulty a little further back; it does not solve it.

To eliminate interventions from the universe is not to remove design. The most profound theists have denied such interruptions of the course of Nature. Leibnitz is an illustrious example of this. Janet declares him to have been the true author of the theory of evolution, by his "Law of Continuity," of "In sensible Perceptions," and of "Infinitely Small Increments." Yet he also fully believed in final causes. Descartes, who objected to some teleological statements, believed that the Creator imposed laws on chaos by which the world emerged into a cosmos. We know that existing animals are evolved by a continuous process from eggs, and existing vegetables by a like process from seeds. No one ever supposed that there was less of design on this account in their creation. So, if all existing things came at first by a like process from a single germ, it would not argue less, but far more of design, in the universe.

The theory of "natural selection" does not enable us to dispense with final causes. This theory requires the existence of forces working according to the law of heredity and the law of variation, together with a suitable environment. But whence came this arrangement, by which a law of heredity was combined with a law of variation, and both made to act in a suitable environment? Here we find again the three marks of a designing intelligence: preparation, combination, adaptation. That intelligence which combines and adapts means to ends is merely remanded to the initial step of the process, instead of being allowed to act continuously along the whole line of evolution. Even though you can explain by the action of mechanical forces the whole development of the solar system and its contents from a nebula, you have only accumulated all the action of a creative intelligence in the nebula itself. Because I can explain the mechanical process by which a watch keeps time, I have not excluded the necessity of a watchmaker. Because, walking through my neighbor's grounds, I come upon a water-ram pumping up water by a purely mechanical process, I do not argue

that this mechanism makes the assumption of an inventor superfluous. In human industry we perceive a power capable of using the blind forces of Nature for an intelligent end; which prepares beforehand for the intended result; which combines various conditions suited to produce it, and so creates order, system, use. But we observe in Nature exactly similar examples of order, method, and system, resulting from a vast number of combinations, correlations, and adaptations of natural forces. Man himself is such a result. He is an animal capable of activity, happiness, progress. But innumerable causes are combined and harmonized in his physical frame, each necessary to this end. As the human intelligence is the only power we know capable of accomplishing such results, analogy leads us to assume that a similar intelligence presides over the like combinations of means to ends in Nature. If any one questions the value of this argument from analogy, let him remember how entirely we rely upon it in all the business of life. We only *know* the motives which govern our own actions; but we infer by analogy that others act from similar motives. Knowing that we ourselves combine means designed to effect ends—when we see others adapting means to ends, we assume that they act also with design. Hence we have a right to extend the argument further and higher.

The result of what I have said is this: The phenomena of the universe can not be satisfactorily explained unless by the study both of efficient causes and of final causes. Routine scientists, confining themselves to the one, and routine theologians, confining themselves to the other, may suppose them to be in conflict. But men of larger insight, like Leibnitz, Newton, Descartes, and Bacon, easily see the harmony between them. Like Hegel they say: "Nature is no less artful than powerful; it attains its end while it allows all things to act according to their constitution"; or they declare with Bacon that "the highest link of Nature's chain is fastened to the foot of Jupiter's chair." But the belief in final causes does not imply belief in supernatural intervention, nor of any disturbance in the continuity of natural processes. It means that Nature is pervaded by an intelligent presence; that mind is above and around matter; that mechanical laws are themselves a manifestation of some providing wisdom, and that when we say Nature we also say God.\*

JAMES FREEMAN CLARKE.

\* In this brief paper it is not possible even to allude to the objections which have been brought against the doctrine of final causes. For these objections, and the answers to them, I would refer the reader to the work of Janet, before mentioned.

DR. McCOSH.

WHATELY describes the "Fallacy of Interrogation" as consisting "in asking several questions which appear to be but one; so that whatever one answer is given, being, of course, applicable to one only of the implied, may be interpreted as applied to the other." Professor Newcomb has unconsciously fallen into this fallacy. He evidently looks on the questions he puts as one, and speaks of his "postulate," his "position," his "fundamental proposition." But he has mixed up no fewer than three questions, which are not the same, with each other, which have no necessary connection, and are not to be satisfied with one reply. In such cases, logicians enjoin that, in order to detect the ambiguity, each question be answered separately. Thus, if some one were to ask me, "Did you write such an article, without a meaning, and was this wise?" I might have to reply that I did write the article, with a meaning, and that this was wise. The Professor has in fact three questions: (1.) "The whole course of Nature considered as a succession of phenomena is conditioned solely by causes." This is not the same as (2.) "In the action of which causes no regard to consequences is either traceable by human investigation or necessary to foresee the phenomena." (3.) "Is the above postulate consistent with sound doctrine?"

I answer the *first* question affirmatively, only I do not favor the terribly metaphysical word "conditioned" used by scientists in the present day so constantly and so vaguely. With me as with Mill, a physical condition is merely one of the elements of a complex cause. The Professor evidently sets before him a scowling theologian who will not allow him to find out a physical cause of the phenomena of Nature. I admit without reservation that in the Course of Nature every occurrence proceeds from an antecedent cause. "This is a principle founded on a limited series of observations and extended by induction to the whole course of Nature." I am not required here to take up the subject of miracles—say the miracles of healing wrought by our Lord to show that he came to cure the evil in our world. A miracle I define as an event produced by causes not in Nature but beyond it. Miracles are acknowledged by all to be comparatively few and exceptional, and they accomplish their end because they are so. Leaving out miracles, and creation, which belongs to the same order, I hold that in the course of Nature every occurrence is produced by antecedent causes.

I do not very well know what he means by the *third* question,

that his postulate is consistent with "sound doctrine," a phrase which he acknowledges to be "vague." If he means by it simply "truth," then I hold as to whatever is established by induction, not that it is consistent with, but that *it is* sound doctrine. If he means by it religious doctrine, we might have to begin with settling what is sound doctrine. I hold very emphatically that truths of science are to be determined solely by inductive evidence. I believe that in the end no truth of science will be found inconsistent with the truths of religion. They may appear to be so, but this only because we have misinterpreted Nature or misinterpreted Scripture. The ground is now cleared. I admit the *first* question. The *third* is somewhat out of place. But I admit it if the *second* is properly answered. It is sound doctrine in science and in nearly all religions that God is traceable in his works.

The *second* question is the only one in dispute between us. "In the action of Nature, is there no regard to consequences traceable by human investigation, or necessary to foresee the consequences?" Again we have two questions under the appearance of one. But the two are connected and may be answered together. The inquiry is a very important one. It is not exactly, "Is there a God?" but it is "whether his existence is shown by his works." He who asserts that there is no regard to consequences traceable in mundane action is setting aside that argument for the Divine existence which the Scriptures sanction (Ps. xix. 1, Rom. i. 20), and which the great body of mankind have acknowledged to be valid.

Of course I allow that physical causes do not in themselves have any regard for consequences, and that they do not foresee phenomena. The chemical elements are as ready to combine to produce poison as to produce food, and they do not know or feel the pain or pleasure resulting from their action. I do not believe, with pantheists, that intention and end are immanent in Nature. But, discovering these in the dispositions and adaptations of agents, I argue a cause above them, with a plan and purpose. The title of his paper is "Law and Design." He evidently regards "Law" and "Design" as inconsistent with each other, as opponents and rivals. In opposition, I hold that—

I. *There is design in law.* The word law as applied to physical phenomena is vague. Nature in its ultimate analysis seems to consist of bodies with their properties. These bodies are supposed to consist of atoms, and these combined make masses. Do we know the ultimate properties of bodies molecular or molar? All

bodies fall under our notice in masses, and the properties are in combination. In their combination they act in an orderly manner ; and this seems to be what is meant by law. They are called by such names as laws of phenomena, general laws, coördinations, and appear as uniformities, types, periodicities. They are all composite, and are the result of a number of properties adjusted to each other. Such are the seasons, the forms of plants and animals, the evolution of children from parents, and, it may be, of one variety or species of plant or animal from another. Their regularity implies a plan, and consequently design. In particular they are suited to man—or, if any prefer it, man is suited to them ; or, as I prefer it, the two are suited to each other. Some people unreasonably complain that things should proceed according to regular laws ; as, for instance, that fire should always burn, and would rather that God should make them act according to circumstances, and interpose to stop fire from burning a poor man's house or a cathedral. But under such a Divine government no one could foresee the future or provide for it, could know that fire would prepare his food for eating, could have even a motive to partake of food, for he could not know whether food would nourish him.

There are cases in which we can see that there is law which enables us to "foresee" and "predict," and this not by tracing effects to causes, but simply by discovering a preordained order. Professor Peirce tells that at a meeting of a scientific association Agassiz was asked to draw the form of a fish, such as must be in a certain period were one to cast up, and that he went to the board and drew the form. Professor Sedgwick, who was present, now took off a napkin and showed fishes of that very epoch, and the form was found to be the same. Here we have a prediction, not by the law of causality—for the same causes differently disposed might have produced a very different form—but by the law of teleology, or rather homology, implying a plan devised by intelligence.

II. *There is design in the adaptation of one object and agent to another*, whereby special ends are accomplished. It is not needful that I should dwell on these. We have them in Paley, in the Bridgewater Treatises, in the works of Sir C. Bell, Brougham, and many others, accessible to all. We see them in every organ of the body, in the joints, the muscles, the eye, the ear, the hand ; and on the discovery of them every one spontaneously looks for a cause in a designing mind—we feel that we have to abnegate our intelli-

gence if we do not yield to the conviction. An eminent French philosopher, M. Janet, in a work on "Final Causes," lately translated, has defended the arguments and answered objections. There is no antithesis, as the Professor seems to think there is, between efficient and final cause. Aristotle, who introduced the phrases, discovered both, as did also Bacon, and the profoundest thinkers of ancient and modern times. I presume that the Professor sees both the efficient and final in his own telescope: the former in the undulations of light and the glass suited to each other; and the latter in the causes being made to serve an end. The argument is *a fortiori* when we discover the efficient causes in the light, the coats and humors and cones made to form an image on the back of the eye.

The argument is from the evidently designed concurrence of natural causes. Chance, in its largest sense, is an event (1) without a cause, or (2) without a purpose. The scientific philosopher knows that there is no physical occurrence without a cause. The religious philosopher believes that there is no event without a purpose. Is there, then, no such thing as chance? I believe that there is no event without a cause and a purpose too. But there may be *coincidences* of events in which there is no design. I do not know that there must be design when, in a promiscuous company, half the people have the same Christian name, in the resemblance of certain rocks to the head of Bonaparte, or in so many eminent men having been born in 1769. But surely where there is room for chance there may be room for design; where there is room for undesigned coincidences there may be room for designed concurrences. When I notice a combination of independent agencies to effect a beneficent end, such as the eye, the ear, the hand, I see clear traces of a purpose. I place under the same head the provisions which have been made beforehand, and from the beginning, for the encouraging of virtue, for the restraining of evil, for hastening on the cause of religion and humanity, for answering prayer, and for relieving distress.

Professor Newcomb puts the case of the burning of a theatre, and supposes that, on inquiring into its meaning, three answers might be given. I do not accept his answers, and I propound three others, wishing my readers to compare his with mine: 1. The occurrence was produced by causes which we should inquire into, and which we may or may not be able to discover. 2. These causes were set agoing by God, and have fulfilled his purpose. 3. We may or may not be able to find out the purpose. In all cases reli-

gion, by its highest authority, forbids us to argue the existence of wickedness because the persons have suffered. "Suppose ye that these Galileans were sinners above all the Galileans because they suffered such things? I tell you nay." This does not preclude us, when the wickedness has been proved, from discovering an intended connection between the sin and its punishment. I can believe both in a physical agency and a moral purpose.

I may remark here that there seems, among some of our scientists in the present day, to be a derangement of mental vision produced by their gazing exclusively on some one object. God has given to every man two eyes; and there are benefits derived from binocular vision—it enables us, as the Irishman said, to look round a corner, and see more than one side of an object. But by looking so long through a microscope some seem to have become one-eyed. There is no good end to be gained by setting the two schools to which the Professor refers, the scientific and the theological, against each other. The business of the physicist may be simply to discover mechanical force, and of the physiologist to trace the processes of life, and of the psychologist to discover the faculties of the mind. The business of the theologian is to discover the operations of God. He is a *narrow* man who in inquiring into Nature can discover only mechanical force—while he overlooks vital and psychical agencies. He is also a narrow man who on finding these efficient causes overlooks that evidently designed concurrence of efficient causes which constitutes final cause. On the other hand, the religious man is so far a narrow man who will not allow scientists to discover physical cause. The truly enlightened man will delight to discover both, and will see no inconsistency between them. In particular, while seeing efficient causes manifesting the power of God, he also discovers benignant ends exhibiting the wisdom and goodness of God.

JAMES McCOSH.

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NOTE.—A rejoinder by Professor Newcomb will appear in the next issue of the "Review."—EDITOR.